

Large-Area, UV-Optimized, Back-Illuminated Silicon Photomultiplier Arrays, Phase I

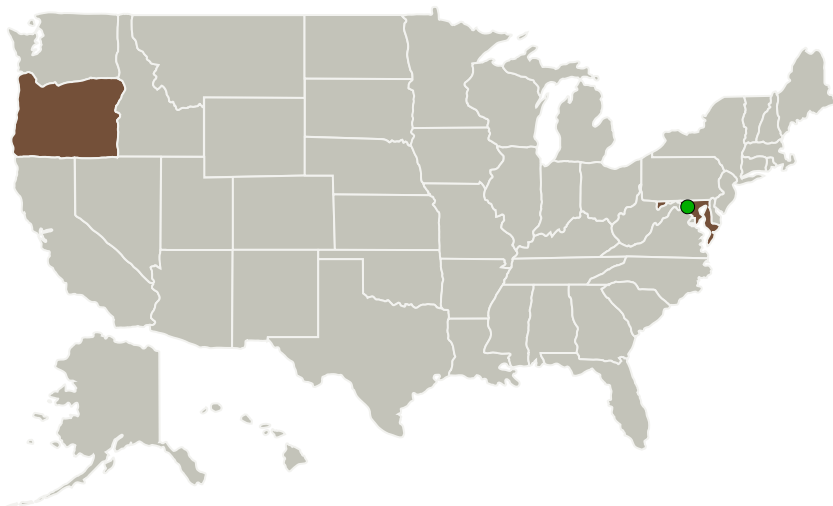
Completed Technology Project (2011 - 2011)



Project Introduction

Existing photocathode-based technologies for visible and UV instruments lack sensitivity, are bulky, and have limited reliability. Solid-state silicon photomultipliers (SiPMs) are efficient, light, and reliable, but the front-illuminated designs demonstrated to date have poor UV response, limited sensitive area, and limited optical fill-factor. In the proposed program, back-illuminated, back-thinned SiPMs optimized for UV response and scalable tiling over very large areas will be developed for observation of air showers from ultra-high energy cosmic rays (JEM-EUSO) as well as for visible-wavelength spectrographic and photometric instruments planned for future telescopes (OWL). Short-wavelength light is absorbed near the surface of a silicon detector, and moving the optical entry surface to the back side of the wafer will enhance UV response by ensuring that all photocarriers from UV photons are generated on the correct side of the junction for efficient avalanche multiplication. Placing the optical entry surface on the back of the wafer will also improve optical fill factor because it will no longer be necessary to shine light through the quench resistor network on the front surface of the detector. Lastly, back-thinning the detector wafer will significantly reduce the mass per unit area of the focal plane array. In Phase I, SiPMs will be back-thinned to demonstrate enhanced UV response, and edge-butttable SiPM arrays that make optimal use of a standard 22-mm CMOS reticle will be designed. In Phase II, large-area back-illuminated SiPMs will be fabricated and demonstrated. Voxel anticipates that its technology will enter the program at TRL=3, finish Phase I at TRL=5 or 6 (goal), and exit the Phase II program at TRL=7.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Voxtel, Inc.	Lead Organization	Industry	Beaverton, Oregon
● Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations	
Maryland	Oregon

Project Transitions

**February 2011:** Project Start**September 2011:** Closed out**Closeout Documentation:**

- Final Summary Chart(<https://techport.nasa.gov/file/140196>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Voxtel, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Vinit Dhulla

Co-Investigator:

Vinit Dhulla

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Technology Maturity (TRL)

Start: **3**
Current: **6**
Estimated End: **6**



Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.1 Remote Sensing Instruments/Sensors
 - └ TX08.1.1 Detectors and Focal Planes

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System